Proton Therapy Facility Start-up and Workflow
The Roberts Proton Therapy Center

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May 19, 2010
If you would persuade, you must appeal to interest rather than intellect.

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Why Proton Therapy?

• We believe it will be better for patients
• Advancing clinical care, education & research is our mission
• Fits with the strategic objective of offering state of the art tertiary care
• Proton therapy is complementary to biological approaches for treating cancer
• Proton therapy provides important research opportunities
• Proton therapy is expanding worldwide; our trainees need to be prepared for the future of radiotherapy
History

• First Penn initiative in 1997 – the vendor was selected, the building was designed and land was acquired.
• New RFP released in 2003 – 6 vendors were considered and an external review reduced that to 3 vendors.
• Business Plan formulated
• Contract with IBA signed in June 2006 - nearly ten years had elapsed from the first initiative. The first patient was treated on January 26, 2010.
Vendor Selection

- Experience
- Proton Therapy Equipment Package
- Long-term future in marketplace and viability
- Resources to deal with unforeseen issues (both financial and expertise)
- Collaboration with conventional equipment vendors
- Financial Package
Basic Equipment

- 4 Gantries
- 1 fixed beam room
- 5 Conventional linacs
- 2 CT-Simulators
- MR-Simulator
- PET-CT Simulator
- 1 conventional Simulator
IBA Proton Therapy System at The University of Pennsylvania

- Purpose built MLC for proton therapy
- Cone Beam CT on the gantry – in development
- Fast beam switching time between $T_x$ rooms – 13 sec average
- Proton set-up room
- Advanced beam scheduling
Full Operations

- 16 Hours of Operations M→F
- 8 Hours of Operations Sat
- Photon Patient Load (170-200 per day)
- Project 160-170 patients per day on Protons when fully operational
- 8 hours of beam time dedicated to Pediatric patients
Roberts Proton Therapy Center

• Fully integrated proton and photon facility
• Advanced imaging techniques used for treatment planning & target localization
  • MR, CT, PET-CT
• Will use multi-leaf collimators and developing on board imaging -cone beam CT scanning & passive PET
• Proton therapy facility fully integrated with all cancer services under one roof
Key Issues in Implementation

• Form a Core Team
• Develop Strategic Partners
• Establish Overall Goals and Objectives
• Develop a Project Plan
• Implementation of Plan
• Focus on Major Issues
  • Technology & Development, Research, Operations
Before we started......

- Senior leadership must be fully invested from the beginning
- Be prepared to devote a lot of time on the project
- Be flexible with the implementation plans. Things will go wrong – managing expectations
- Stick to your core principles & beliefs
Core Team of Expertise in Proton Therapy

- The formation of a Core Proton Therapy Team is critical to the success of the project. Under resourcing this team is a mistake
- The Core Team is responsible for the vision, development of the project plan, and implementation
- Key interface with the vendor
- Importance of including physicians, physicists, and administrators/business
- Importance of including your financial sponsor
- A cohesive team with a single vision/plan has helped us overcome the inevitable challenges
Penn Core Team in Proton Therapy

- 3 Medical Physicists with accelerator expertise and extensive clinical experience
- 3 Physicians who are active clinicians who understand the clinic/work flow
- Departmental Chief Operating Officer
- 1 Senior level Health System Administrator
- 1 Project Manager
Penn Team in Proton Therapy

- Six full time physicists working on this project
- Four Physicians working on various aspects of the project
- All physicians (15) in the department are working on the research protocols
- Administrative assistant support
- Research nurse/data management support
- IT support
- CHOP
- Department of Defense
Strategic Partners

• University of Pennsylvania Health System
• School of Medicine
• Children’s Hospital of Philadelphia
• Department of Defense
  • Walter Reed Army Medical Center
  • Bethesda Naval Hospital
• Form the basis for our Steering Committee which meets biweekly and provides oversight
Strategic Partners

• These are the groups that believe proton therapy is an important part of their organizations strategic plan/initiatives

• Importantly, there is a financial stake in the project

• Funded without debt
  • UPHS – majority owner
  • CHOP
  • The Roberts Family
  • Department of Defense – Development funds
Children’s Hospital of Philadelphia (CHOP)

- Compelling clinical rationale to treat children with proton therapy
- CHOP has a strong presence in the region
- The CHOP partnership
  - Financial – “CHOP gantry”
  - Clinical – joint clinical space for pediatric patients
  - Research – participation in clinical trials
  - IT – EMR, imaging, etc.
Penn-WRAMC Telemedicine Effort

–The staff at WRAMC will be involved in the care of their patients even when they are at Penn receiving proton treatments. We envision (1) combined tumor boards to select the patients suitable for proton therapy, (2) the possibility to perform the CT-simulation and treatment planning at WRAMC, (3) joint clinical protocols, and (4) combined chart rounds and morbidity-and-mortality conferences.

–To that end we have combined videoconferencing with the ability to share the treatment planning application. We expect multiple users at each site so we are investigating an economical solution using PVX and Internet2.
Proton Steering Committee

• Led by Department Chair and Senior VP from the Health System
• Biweekly meeting at which the Proton Team provides a high level overview of progress & obstacles
• CHOP & DOD representation
• The decision-making committee for protons
• Formal Project Plan
Goals and Principles

• Develop goals and principles for the University of Pennsylvania Proton Therapy Facility
• Extensive site visits of existing facilities and time spent by each member of the team in their area of expertise
• Learn from those that have paved the way
• Form & maintain internal and external partnerships with resources to ensure the success of the project- CHOP, WRAMC
Goals and Principles

• Provide the highest quality care to patients of UPHS-affiliated hospitals and of our collaborators: Children’s Hospital Of Philadelphia and Walter Reed Army Medical Center.

• Integrate conventional and proton therapy in one department.

• Design and construct a center where safety & efficiency of patient care are paramount.

• Apply advanced technology to achieve these goals
  • localization and monitoring of patient position
  • Imaging
  • Informatics
Goals and Principles

• Recognize that the revolution occurring in several areas of imaging could amplify the benefit of proton therapy.

• Apply advances in conventional radiation therapy to proton therapy.

• Vendors should deliver state-of-the-art at the time of delivery, not what is state-of-the-art today.

• There must be continuous investment into the facility.
Integration

• Facility will be fully integrated between conventional and proton therapy
• Same technicians, dosimetrists, nurses and physicians treating all patients regardless of modality
• Same immobilization devices, couch tops, gating devices, and imaging equipment throughout
• Patients will be transferred easily between proton and conventional treatment
Integration

- Single planning session with remote capability
- Single integrated IT system for entire department connected to both HUP, WRAMC and CHOP information networks
- Integrated Electronic Medical Record (EMR)
- Ability to treat with photons at other sites with the goal of integrating treatment plans
Imaging

• Imaging is a driving force for future developments in proton therapy
• Proton therapy should not have inferior imaging to conventional linear accelerators
• This facility will incorporate the latest in imaging for proton therapy to realize its full potential
• Different imaging modalities will be required for different sites of treatment
Imaging

- On board imaging
  - Orthogonal Flat panel imaging
  - Cone Beam CT – in development
  - Passive PET Imaging – in development
  - Calypso system – evaluation in progress

- Treatment planning
  - CT
  - MRI
  - PET
Operational Efficiency

• Integration of every component
• All components from a single vendor with a single point of responsibility
• Single internal administrative oversight
• No incentive to treat patients with a particular modality
Approaches to Increase Efficiency

• Setup Room
• Decrease in beam switching time from room to room
• Multi-leaf collimators on all gantries
• Image guidance
• Full electronic integration throughout facility
• “Smart Scheduling”
Developed a Formal Project Plan

- Major milestones established with vendor
- Timeline established
- Financial incentives to vendors for “on time delivery”
- Biweekly formalized review of progress at Proton Steering Committee Meetings
- Flexibility & revision needed
- Ramp up plan
Formal Project Plan

- Linked to the funding, budget & business plan
- Funds for hardware & software
- Working capital
- Yearly budgetary support for personnel, travel, software development/IT infrastructure, ramp up plan
- Re-investment funding
- Dollar-Euro exchange rate
Research

• Establish a research room at the end of the beam line
• Develop a series of preclinical studies to be performed now and when facility is functioning
• Partnership with NASA
• Clinical Research Protocols
Operations

• Smart Scheduling
• Work Flow Analysis
• Integration of Photon operations, hospital, networks, CHOP
• Standardization of workflow
• Training of personnel
• Hiring of new personnel
• Formation of a Triage Committee
The Hard Stuff

• Securing the funding
• Communication among all of the strategic partners
• Vendor cooperation & collaboration
• Development obstacles - software
• Constant attention to the project plan
• Focus on the goals & principles – with flexibility
• Time commitment
Patient Triage

• Penn Proton Priority System (PROPS)
• Executive Summary
  • Major Considerations
  • Domains
  • PROP Score
  • Operationalizing PROPS
  • Reviewed by Penn Medicine Leadership
  • Transparency